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IS 8967-1 (1992): Farm Drainage Equipment - Drainage Clay Tiles, Part 1: Tiles with Open Joints [FAD 17: Farm Irrigation and Drainage Systems]



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भाग 1 खुले जोड़ वाले टाइल

(पहला पुनरीक्षण)

Indian Standard

FARM DRAINAGE EQUIPMENT —
DRAINAGE CLAY TILES — SPECIFICATION

PART 1 TILES WITH OPEN JOINTS

(*First Revision*)

UDC 626-862 : 626-823-912 : 691-421

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Price Group 3

FOREWORD

This Indian Standard (Part 1) (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Farm Drainage Sectional Committee had been approved by the Food and Agriculture Division Council.

Farm drainage clay tiles also known as clay pipes are now being extensively used for sub-surface drainage of farms. This standard is intended to assist in production of quality tiles.

The clay tiles used for farm drainage purpose are generally of two types : (a) tiles with open joints, and (b) perforated tiles with collar joints. This standard is issued in two parts, Part I covers tiles with open joints and Part II covers requirements of perforated tiles with collar joints.

This standard was first published in the year 1978. This standard has been revised to incorporate the requirements for the clay tiles joints

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

FARM DRAINAGE EQUIPMENT — DRAINAGE CLAY TILES — SPECIFICATION

PART 1 TILES WITH OPEN JOINTS

(First Revision)

1 SCOPE

This standard (Part 1) covers the requirements and method of tests for clay tiles with open joints for farm drainage purposes.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard.

| IS No. | Title |
|---------------------------|--|
| 3495 (Part 2) : 1976 | Method of test for burnt clay building bricks: Part 2 Determination of water absorption (<i>second revision</i>) |
| 4905 : 1968 | Methods for random sampling |

3 MATERIAL

The tiles shall be made from clay, shale, fire clay, or mixture thereof and burnt.

4 CLASSIFICATION

For the purpose of this standard, the clay tiles based on their physical properties (*see 7.1*) shall be of following three classes:

- a) Light-duty tiles,
- b) Medium-duty tiles, and
- c) Heavy-duty tiles.

5 DIMENSIONS AND TOLERANCES

5.1 The nominal size (internal diameter) of the tiles for each class shall be 80, 100, 125, 150, 200, 250 and 300 mm.

NOTE — Sizes 100 and 125 mm should be preferred for installation purposes.

5.1.1 Permissible variation in diameter for all the three classes of tiles shall be ± 3 percent.

5.2 The thickness of the tiles shall be such that tiles shall meet the physical requirements (*see 7.1*).

5.2.1 Permissible variation between maximum diameters of the same tile at the ends shall be 75, 65, and 65 percent of thickness of wall for light, medium and heavy-duty tiles respectively.

5.3 The nominal length of the tiles shall be not less than 300 mm.

5.3.1 Permissible variation of measured length from the manufacturers specified length shall be ± 3 percent. However, the length shall not be less than the value specified in 5.3.

6 GENERAL REQUIREMENTS

6.1 The tiles shall be uniformly well burnt.

6.2 The tiles shall be uniform in size, shape and free from irregularities, such as, cracks and laminations.

6.3 The tiles shall be free from impurities like particles of stone, lime and other foreign materials visible to the naked eye on the surface or on the fractured surface of the tiles obtained by breaking the sample for crushing strength test.

6.4 The tiles shall be free from any minerals or chemicals that are known to cause slaking or disintegration of the tiles.

6.5 The ends of butt-end tiles of sized more than 150 mm used for mains and sub-mains shall be so regular and smooth as to make possible close joints by turning and pressing together the ends of adjoining tiles. The ends of the other tiles shall be square with their longitudinal axis so that when placed in a straight line in the trench no opening in end contact shall exceed 3 mm.

6.6 The tiles, in dry condition when held free from the ground or tipped on edge and tapped lightly with a hammer having a head not exceeding 110 g in mass, shall give a clear sound.

6.7 The requirements of joints shall be as given 6.7.1 to 6.7.6. 1976, maximam warp shall not exceed 3 percent of length of the tile.

6.7.1 Pipes at the joints shall be laid in the excavated trench to the correct gradient.

6.7.2 Pipes at the joint shall touch each other, that is, end to end or shall be abutting each other at spigot and socket joint.

6.7.3 Joint shall be leak proof and efficient functioning.

6.7.4 Pipes and all other materials to be used for pipes joints shall be new and of good quality.

6.7.5 Various materials excavated shall be stacked sufficiently beyond the edge as may be necessary to avoid damage to the joint.

6.7.6 As far as possible joint shall be laid straight in falling gradient.

7 PHYSICAL REQUIREMENTS

7.1 When tested in accordance with the method given in Annex A the tiles shall conform to the physical requirements, for the class specified, as prescribed in Table 1.

7.2 When measured in accordance with the procedure laid down in 3 of IS 3495 (Part 4) :

8 SAMPLING

For type testing 5 tiles shall be selected at random. For lot acceptance unless otherwise agreed to between the purchaser and the supplier the sampling procedure as given in Annex B shall be followed.

9 MARKING AND PACKING

9.1 Marking

Each tile shall be marked in a suitable manner with the following information:

- a) Manufacturer's name or identification mark,
- b) Class,
- c) Size, and
- d) Length.

9.1.1 Each tile may also be marked with the BIS Certification Mark. Details are available with the Bureau of Indian Standard.

9.2 Packing

The tiles may be packed for safe handling as agreed to between the purchaser and the supplier.

Table 1 Physical Requirements for Clay Drainage Tiles with Open Joints
(Clauses 7.1 and B-2.3)

| Sl No. | Nominal Size, mm | Light-Duty Tiles | | | | Medium-Duty Tiles | | | | Heavy-Duty Tiles | | | |
|--------|------------------|-----------------------------------|------------|--|------------|-----------------------------------|------------|--|------------|-----------------------------------|------------|--|------------|
| | | Crushing Strength kN/m, Min | | Water Absorption by 5-h Boiling Percent Max | | Crushing Strength kN/m, Min | | Water Absorption by 5-h Boiling Percent Max | | Crushing Strength kN/m, Min | | Water Absorption by 5-h Boiling Percent Max | |
| | | Average of 5 tiles | Individual | Average of 5 tiles | Individual | Average of 5 tiles | Individual | Average of 5 tiles | Individual | Average of 5 tiles | Individual | Average of 5 tiles | Individual |
| | | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| (i) | 80 | 11.7 | 9.9 | 13 | 16 | 16.0 | 14.4 | 11 | 13 | 20.4 | 18.4 | 11 | 13 |
| ii) | 100 | 11.7 | 9.9 | 13 | 16 | 16.0 | 14.4 | 11 | 13 | 20.4 | 18.4 | 11 | 13 |
| iii) | 125 | 11.7 | 9.9 | 13 | 16 | 16.0 | 14.4 | 11 | 13 | 20.4 | 18.4 | 11 | 13 |
| iv) | 150 | 11.7 | 9.9 | 13 | 16 | 16.0 | 14.4 | 11 | 13 | 20.4 | 18.4 | 11 | 13 |
| v) | 200 | 11.7 | 9.9 | 13 | 16 | 16.0 | 14.4 | 11 | 13 | 21.8 | 19.7 | 11 | 13 |
| vi) | 250 | 11.7 | 9.9 | 13 | 16 | 16.0 | 14.4 | 11 | 13 | 22.6 | 20.4 | 11 | 13 |
| vii) | 300 | 11.7 | 9.9 | 13 | 16 | 16.0 | 14.4 | 11 | 13 | 24.8 | 22.3 | 11 | 13 |

ANNEX A

(Clause 7.1)

TEST FOR FARM DRAINAGE CLAY TILES WITH OPEN JOINTS

A-1 TEST FOR CRUSHING STRENGTH

A-1.1 Test Specimen

Take five tiles of each specified class and length. Immerse the tiles in water for at least one hour and not more than 2 hours immediately prior to testing.

A-1.2 Apparatus

A-1.2.1 The loading device may consist of any mechanically driven or hand-powered device and shall meet the requirements given in A-1.2.2 to A-1.2.4.

A-1.2.2 It shall be substantially built and rigid throughout so that distribution of load to the specimen will not be affected appreciably by deformation or yielding of any part.

A-1.2.3 It shall provide for continuous application of load at uniform rate from 7 300 to 29 000 N per linear meter minute.

A-1.2.4 It shall provide means for determination of load with an error not exceeding 2 percent.

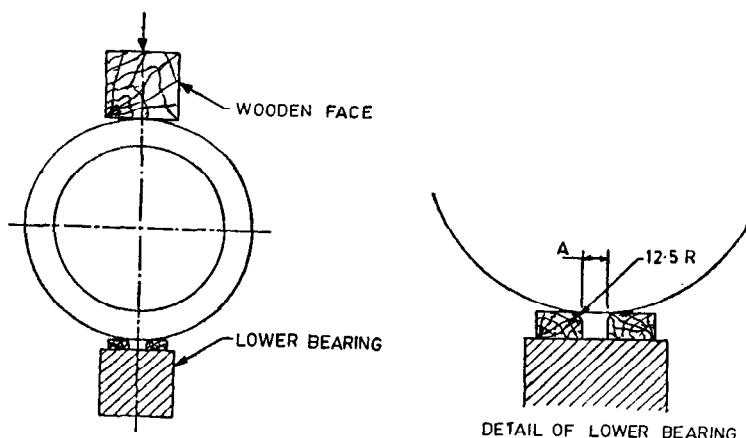
A-1.3 Procedure

A-1.3.1 Make strength test by the three-edge bearing method.

A-1.3.2 The lower bearing for the tile shall consist of two wooden strips free of knots and with vertical sides, having their interior to corners rounded to a radius of 12.5 mm (*see* Fig. 1). The strips shall be straight and shall be securely fastened to a rigid base with the interior vertical sides parallel and spaced a distance apart not less than 42 mm nor more than 83 mm per meter of the nominal tile diameter with a minimum spacing of 25 mm (*see* Fig. A in 1). Make sure the upper bearing is straight and true from end to end and apply the load through a wood beam or wooden-faced metal beam of such dimensions that it will transmit the full load without appreciable deflection.

A-1.3.3 Upper and lower bearings shall extend full length of tile. Symmetrically place the tile between the two bearings, and center the application of load at the center of the length of tile.

A-1.3.4 Plaster of paris bedding fillets may be used on the lower and upper bearings. Before the tile is placed, cast a fillet of plaster of paris thick enough to compensate for inequalities in the tile barrel on and between the lower bearings and place the tile in position on the fillet while the plaster is still somewhat plastic. Cast a similar fillet along the length



All dimensions in millimetres.

FIG. 1 THREE-EDGE BEARING

of the crown of the tile. This fillet shall have a width equal to that of the upper block and, for this test, the upper bearing block shall have a width 25 mm greater than the distance between the strips constituting the lower bearing.

A-1.3.5 Proven types of bearings, such as hard rubber or sand-filled high-pressure hose may be used instead of wooden bearings as specified in A-1.3.2.

A-1.3.6 Accurately center all bearings and specimens of tile to secure a symmetrical distribution of loading on each side of the centre of tile in every direction.

A-1.3.7 Apply load as nearly, continuously as testing equipment permits until the specimen fails.

A-1.4 Calculation and Report

Report results of strength tests in Newtons per linear meter of tile. Report separately for each of the tiles tested together with their average.

A-2 TEST FOR WATER ABSORPTION

A-2.1 Test Specimen

A-2.1.1 Test specimen shall consist of segments taken from each of the five tile broken during

the crushing strength test (*see* A-1) and shall be selected in the manner given in A-2.1.2 and A-2.1.3.

A-2.1.2 The sample shall consist of one full-length quarter segment taken from each of the five tiles broken in the strength test. By quarter segment is meant one of the four pieces into which a tile usually breaks in the strength test. The segment selected should have approximately uniform width. If the tile breaks in such a manner that a satisfactory quarter segment cannot be obtained, the absorption test may be made on two or more pieces whose combined area approximate the area of a quarter tile of that size selected so that both ends and center portions of the tile are represented. The average absorption of the pieces so selected shall be considered to be the absorption for that tile.

A-2.1.3 All absorption test specimens shall be apparently sound, solid pieces of tile; shall not show brakes or badly shattered edges; and shall have laminations only to the extent that these are representative of the tile from which they are taken.

A-2.2 Procedure

Five-hour boiling water test as given in 3.2 of IS 3495 (Part 2) shall be followed.

ANNEX B

(*Clause 8.1*)

SAMPLING OF CLAY TILES

B-1 SCALE OF SAMPLING

B-1.1 Lot

The collection of clay tiles of the same class and size, manufactured under relatively similar conditions of production shall constitute a lot.

B-1.2 For ascertaining the conformity of the tiles in the lot samples shall be selected and tested from each lot separately.

B-1.3 The number of tiles to be selected from a lot shall depend on the size of the lot and shall be in accordance with Tables 2 and 3.

Table 2 Scale of Sampling and Permissible Number of Defectives for Visual and Dimensional Requirements

(*Clauses B-1.3 and B-2.1*)

| Lot Size | | | Sample Size | Permissible No. of Defectives |
|----------|-----------|--------|-------------|-------------------------------|
| (1) | | | (2) | (3) |
| Up | to | 500 | 5 | 0 |
| 501 | „ | 1 000 | 8 | 0 |
| 1 001 | „ | 3 000 | 13 | 1 |
| 3 001 | „ | 10 000 | 20 | 2 |
| 10 001 | and above | | 32 | 3 |

Table 3 Scale of Sampling for Physical Requirements(*Clauses B-1.3 and B-2.2*)

| Lot Size | Warpage | | Sample Size for Crushing Strength and Water Absorption |
|------------------|-------------|-------------------------------|--|
| | Sample Size | Permissible No. of Defectives | |
| (1) | (2) | (3) | (4) |
| Up to 500 | 5 | 0 | 5 |
| 501 to 1 000 | 5 | 0 | 5 |
| 1 001 to 3 000 | 10 | 0 | 5 |
| 3 001 to 10 000 | 10 | 0 | 10 |
| 10 001 and above | 15 | 1 | 10 |

B-1.3.1 The clay tile shall be selected at random. In order to ensure the randomness of selection either random sampling or certified sampling method in accordance with IS 4905 : 1968 may be followed.

B-1.3.1.1 In random sampling the sample is taken in such a way that every item in the lot has the same chance of appearing in the sample.

B-1.3.1.2 In stratified sampling the lot is divided into convenient sections (real or imaginary) and the sample is taken from each section of the lot at random.

B-1.3.2 Samples shall be taken by one of the methods given in **B-1.3.2.1** and **B-1.3.2.2** sampling being arranged so as to yield the number of sample tiles required.

B-1.3.2.1 Sampling in motion

Whenever practicable a sample shall be taken when the tiles are being moved, for example during loading or unloading. The lot shall be divided into a number of convenient portions such as when equal number of tiles are drawn from each of these portions, a number of tiles required for inspection and testing is provided.

B-1.3.2.2 Sampling from a stack

When it is necessary to take a sample from a stack, the stack shall be divided into a number of real or imaginary sections and the required number of tiles selected from each section as given in **B-1.3.2.1**. For this purpose tiles in the upper layers of stack shall be removed to enable units to be sampled from places within

the stack. In case of tiles loaded in lorries/trucks if it becomes necessary for any reason to stake samples in that stage, the sample tiles shall be taken from a number of lorries/trucks such that when equal number of tiles are drawn from each of the lorries/trucks the number of tiles required for the inspection and testing is provided.

B-2 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

B-2.1 Visual and Dimensional Requirements

All the tiles selected as in **B-1.3** (Table 2) shall be examined for visual and dimensional requirements given in **5.1** to **5.3** and **6.1** to **6.6** in the specification. A clay tile failing in any of these requirements shall be considered as defective. If the number of defective found in the sample is less than or equal to the corresponding number given in col 3 of Table 2, the lot shall be considered as satisfying these requirements. However, if the number of defectives in the samples is greater than the corresponding number, the lot shall be deemed as not having met these requirements.

B-2.2 Warpage

The lot which has been found satisfactory in respect of visual and dimensional requirements shall then be tested for warpage as given in **7.2** of the specification. Clay tiles for this purpose shall be taken at random from those already selected according to **B-2.1** and found satisfactory. The number of tiles to be selected and tested for this purpose shall be according to col 2 of Table 3. Any tile failing in this requirement shall be considered as defective. If the number of defectives in the sample is less than or equal to corresponding permissible number of defectives given in col 3 of Table of 3, the lot shall be declared as meeting the requirement of warpage; otherwise not.

NOTE — For this purpose the warpage for each individual tile in the sample shall be reported.

B-2.3 Crushing Strength and Water Absorption

The lot having been found satisfactory in respect of visual, dimensional and warpage shall be finally tested for these requirements as given in the specification. The tiles for this purpose shall be taken at random from those already tested according to **B-2.2** and found satisfactory. The number of tiles to be selected and tested shall be according to col 4 of Table 3.

B-2.3.1 Whenever more than five tiles are selected from a lot, the tile shall be separated into different sets of five tiles each at random. The individual test results and the average for each set shall be reported. For example, for a lot of 5 000 tiles, 10 tiles shall be selected at random and then randomly separated into two sets each having five tiles. The individual; test result for ten tiles and the average of both the sets shall be reported.

B-2.3.2 The lot shall be declared as conforming to these requirement if individual test results for tiles meet the corresponding requirement given in Table 1 and average of each set of five tiles meets the corresponding requirement also given in Table 1, otherwise not.

B-2.4 The lot shall be declared as conforming to the requirements of the specification if **B-2.3** is satisfied.

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